Human Resources,
Labour and
Employment

Occupational Health
and Safety Branch

Hon. Grant Sorenson
Minister

It's in your hands.

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Back Injury Prevention

BACK INJURY PREVENTION

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Summary

Back injury presents one of the most common and costly problems in occupational health. The reported incidence of back injury and accidents related to manual material handling is high. Overall costs are greater for injury to the back than for any other parts of the body.

There are multiple causes and aggravating factors for occupational back pain. Preventive programs, based mainly on training on lifting, have been unsuccessful in reducing the incidence of back pain compensation claims. If prevention is to be successful, a more realistic appraisal of the causes is essential. A program for prevention should be tailored to workplace needs.

This booklet presents the problem, recommends some solutions and explains the responsibility of the employer and the worker under The Occupational Health and Safety Regulations.

I. Saskatchewan Trends

There has been a steady increase in the number of claims for back injury in proportion to total claims in Saskatchewan since 1972. Table 1 summarizes the number of Workers' Compensation Board claims for low back injury for the years 1972-1986. The number of claims increased from 3,924 (14.6% of total claims) in 1972 to 6,508 (17.6% of total claims) in 1986. Not only the costs but also the number of back injuries are continuing to increase. This progressive increase in back injuries must be of considerable concern to employers and workers.

Certain industries have continually high rates of back injuries, as shown in Table 2. Although many of them have intensive lifting tasks, it is not possible to estimate the proportion of injuries which are related to manual handling. Among the "high risk industries", hospitals, nursing and special care homes, telecommunication, bus transportation, messenger service and taxi cabs and warehousing have the worst record of back injuries.

The high risk occupations are listed in Table 3. Certain occupations in the high risk industries seem to contribute most to the high back injury rates. These tables should be useful in setting priorities within any preventive program.

No breakdown can be made, from the available statistics, for the exact cause of the injury. It is expected, based on other statistical studies, that up to 74% of back injuries are attributable to "lifting, etc". Underfoot accidents, other causes of loss of balance and sudden blows to the back have been highlighted, in some studies, as serious causes of back injury. However, it is generally conceived that most of the back claims are for back pain that has not been caused by trauma. The number of days lost (compensation and rehabilitation) given in Table 4 is a guide to the severity of injury. About 45% of the total number of claims resulted in more than 5 lost days.

Table 1 - An Analysis of Workers' Compensation Board Back Injury Claims

A. Claims Settled

Year	Back Claims*	Total Claims	Back Claims as a % of Total Claims
1986	6,508	37,034	17.6
1985	6,529	37,437	17.4
1984	6,550	38,080	17.2
1983	6,300	34,048	18.5
1982	6,532	36,942	17.7
1981	6,760	40,031	16.9
1980	6,087	38,470	15.8
1979	5,745	38,434	14.9
1978	5,298	34,240	15.5
1977	5,559	35,965	15.5
1976	5,176	34,662	14.9
1975	4,521	29,622	15.2
1974	4,283	28,547	15.0
1973	3,680	24,869	14.8
1972	3,924	26,943	14.6

B. Permanent Disability Claims

Year	Back Claims*	Total Claims	Back Claims as a % of Total Claims
1986	28	190	14.7
1985	103	318	32.4
1984	216	581	37.2
1983	187	519	36.0
1982	197	592	33.3
1981	239	763	31.3
1980	163	487	33.5
1979	278	732	38.0
1978	198	714	27.7
1977	155	657	23.6
1976	140	530	26.4
1975	102	369	27.6
1974	52	174	30.0
1973	80	278	28.8
1972	101	402	25.1

Source: Saskatchewan Workers' Compensation Board Annual Reports

* Claims identified by nature of injury as involving the 'dorsal spine' or the 'lumbar spine'.

Table 2 - High Risk Industries*

Industry	Number of Employers	Back Claims as % of Total Claims
Hospitals, nursing and special care homes	406	31.4
Telecommunications	2	31.0
Bus transportation, messenger service and taxicabs, warehousing	340	29.7
Commercial trucking	1,553	22.0
Commercial, chartered and pilot training flying; repair of aeroplanes	60	21.6
Railways	3	21.5
Dry goods, drugs and similar commodity marketing	2,817	21.9
The Crown in right of Saskatchewan	17	21.4
Grain elevators and inland terminals	13	20.4
Wholesale implements without service	25	20.4
Bakeries, dairy products, soft drinks, food preparation, distilleries and breweries	253	20.3
Average of all industries		17.6

* Back claims > 20% of total claims
Based on 1986 Workers' Compensation Board Statistics

Table 3 - High Risk Occupations *

Occupation	Back Claims as a % of Total Claims
Nursing aides and orderlies	42.9
Nurses, graduate, except supervisors	36.2
Bus drivers	35.2
Mail and postal clerks	34.2
Management occupations, construction operations	31.4
Physio and occupational therapists	31.0
Taxi drivers and chauffeurs	30.3
Travel clerks, ticket, station and freight agents	28.9
Driver-salesmen	28.8
Packaging occupations, NEC**	28.3
Stock clerks and related occupations	27.9
Other occupations in social work and related, NEC	26.6
Painters, paper hangers and related occupations	26.4
Surveyors	26.2
Janitors, char workers and cleaners	26.2
Tellers and cashiers	25.8
Motor transport operators, NEC	24.7
Other rock and soil drillers	24.2
Railway sectionmen and trackmen	24.1
Other occupations in teaching and related, NEC	24.0
Longshoremen, stevedores and freight handlers	23.3
Mail carriers	23.1
Electrical and related equipment installers and repairers, NEC	22.7
Occupations in welfare and community services	22.6
Plasterers and related occupations	22.4
Metal smelting, converting and refining furnacemen	22.1
Shipping and receiving clerks	22.0
Conductors and brakemen, railway	22.0
Truck drivers	21.7
Salesmen and salespersons, commodities, NEC	21.5
Sales clerks, commodities	21.2
Electrical power linemen and related	21.2
Supervisors: sales occupations, commodities	21.1
Foremen: mine, quarry, oil and gas field	20.1
Bonders and cementers, rubber, plastic and related products	20.6
Food and beverage processors, NEC	20.1
Average of all occupations	17.6

* Back claims >20% of total claims among occupations reporting more t
back claims. Based on 1986 Workers' Compensation Board statistics
** NEC - Not Elsewhere Classified

Table 4 - Breakdown of Back Injury Claims of 1985 by Lost Workdays*

No time loss	32%
Less than or equal to 5 days	23%
>5 days to 22 days	26%
>22 days to 200 days	17%
Greater than 200 days	2%
	100%

Based on 1986 Workers' Compensation Board Statistics

* Compensation plus rehabilitation

The cost to the employer of an injury attributed to work includes the results of the disruption of work at the time of the injury and the costs of labour replacement pending a return to work of the casualty, in addition to the medical, rehabilitation and insurance costs. No cost evaluation per injury has been made in Saskatchewan, but a cost estimate of $2,000 - $3,000 can be made based on experience in other provinces. This of course does not include the pain, suffering and, in many cases, financial loss to the worker or the effect on his/her family.

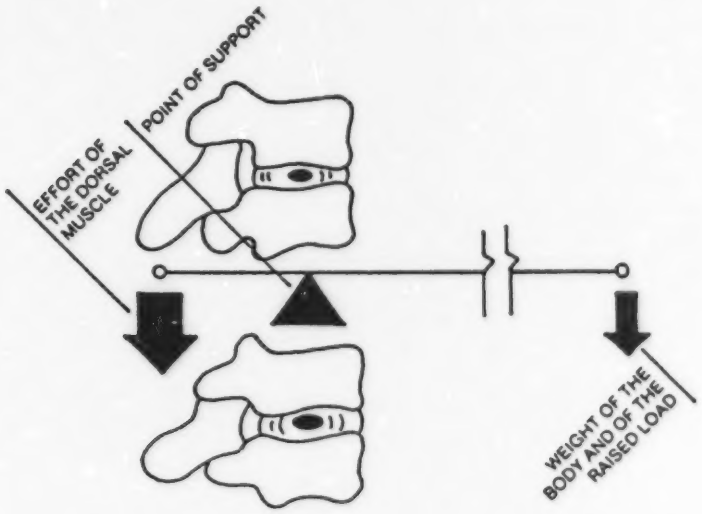
II. The Back and Its Mechanics

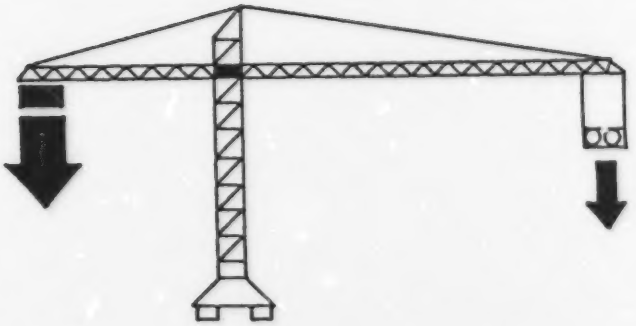
A. Structure and function

The spine is a stack of fitted blocks (vertebrae) separated by shock absorbing pads called discs. To stabilize this set of blocks the edges are connected to the ribs by ligaments. These run between the blocks, up and down the spine and in a large sheet across the back to connect to the stomach muscles in front. On top of the ligaments are long thin muscles that keep us erect but are not very good for lifting.

A controlled interaction between several muscles is required for the spine to remain intact, the blocks to continue to be aligned and the ligaments and muscles not to be torn. These include the hip extensor muscles for the power of heavy exertion, the paraspinal muscles for lighter tasks, and the stomach muscles for the balance between ligament and spinal motion and for adjusting the whole system to the job that must be done. Therefore, hip disease limiting extension, and/or weak and imbalanced muscles in the hip, abdomen and back would increase the likelihood that imbalance or undue stress in the system could occur and cause damage.

The body works as a tower crane or a lever with the vertebrae acting as a point of support or fulcrum but with an uneven arm. The back muscles, located near the point of support, represent the short arm. The arms and other parts of the upper body handling the load represent the long arm. Lifting a load, therefore, greatly increases the torque on the point of support.





Similarity between mechanical function of a crane and that of spine.

B. Injury

There are two ways that injury can occur:

- By direct force or axial overload. This will cause the first damage to the disc.
- By indirect force or torsional (twisting) overload.

Injury to the muscles is called a strain, to the ligaments a sprain or to the bones a fracture.

At an early stage, the injured worker may have an area of contracted muscle and difficulty bending to the side. There may be some changes of the vertebral joints on x-ray. It is not clear whether it is the muscles acting on the joint or the joint itself that may be responsible for the patient's complaints. It is not clear as well, whether the strain on the joint comes first and is followed by the contraction of muscle to protect the joint or whether abnormal muscle function leads to joint strain. In the majority of cases, the pain apparently results from inflammation, swelling and spasm of muscle.

Muscle strain can occur when poor posture puts a stress on the spine or when there is unco-ordinated contraction of the muscle. Fatigue, heat and cold can predispose the worker to problems of unco-ordinated muscle movement.

Damage to the joints between the vertebrae can occur from rotation or compression stresses. This damage can lead to changes in the disc and misalignment of the vertebral joints.

The pain and damage will vary with the severity of the injury, the structure in the spine which is affected and the level in the spine where it occurs.

The natural history of a low back injury usually follows a course of initial pain with painful movement, local tenderness, contracted muscles and decreased movement of the back. Over the recovery period, the symptoms may be similar but less. Severe pain may be expected when coming to a standing position after bending. The final recovery stage is characterized by low back pain of decreasing severity, some continued muscle tenderness, stiffness, some limitation in movement and sometimes a change in the alignment of the spine.

It must be remembered that other back problems that are not the result of injury can cause similar symptoms.

C. Recovery

Treatment in the initial stages of injury can be any combination or all of the following depending on the type and extent of injury:

- A short course of painkillers and bed rest.
- Spine education program that includes basic anatomy, low back care, exercises, correct posture and weight reduction where indicated.
- Manipulation.
- Injection of a small amount of anaesthetic into the joint.
- Rehabilitation programs to help the injured worker to return to the work force. In the absence of contraindications by the physician, early mobility helps speed up the recovery process. Studies have shown that workers with back complaints who are off work for a prolonged period of time have less chance of returning to productive employment.

If the injury involves the protrusion of the disc from between vertebrae, the patient may be put on complete bedrest. This may be up to three weeks. If there is not sufficient recovery, local injections of medication into the disc may be considered. Failing this, surgery may be considered. Only a very small fraction of all back problems require surgery.

Unfortunately, there may be little relationship between the amount the individual is disabled and the extent of the injury. An individual's reaction to the injury and subsequent treatment vary greatly. Back pain cannot be measured since the severity of pain actually experienced has no direct relationship to the underlying lesion.

The extent of recovery depends upon:

- The nature and extent of the injury.
- Treatment.
- The patient's attitude and commitment to a major lifestyle change. Once injured the individual must work at all times to keep his back and muscles in good condition to avoid recurrence of the symptoms. This is a lifetime commitment.
- The restructuring of the work environment to alleviate causes of stresses on the spine.
- Participation in a return to work program.

III. Factors Associated With Back Problems

Factors associated with individuals, their jobs and environment that lead to back problems will be presented with an emphasis on prevention techniques that can be applied to the job and the workplace. To date there is no reliable method to identify specific individuals that will develop back problems. However specific job designs and environments have been shown to be more likely to contribute to back injury and therefore, should be considered if prevention is to be achieved.

A. Factors associated with the individual

- There is some evidence to suggest that men tend to be injured at a younger age than women. It is not clear if this is because of the nature of the job or the characteristics of the worker.

- The frequency of back problems is highest in the age range of 25 to 55.

- Height and weight do not appear to be important factors in determining who is more likely to have back problems. There is no evidence for an association between permanent posture (which is determined by the spine curvature) and back problems. There is, however, some evidence of an association between static work posture and back problems.

- Those that injure their back are likely to have injured it before. About 65% of the reported back injuries are recurrences.

- Those that are physically fit may be less likely to injure their back.

- Those that rarely lift on their job have a higher rate of absences for back problems than those who lift regularly. However, back injuries are reported more commonly for heavy than for light work, the younger, unskilled and inexperienced worker being at greater risk.

- Warm-up exercises help to prevent injury in sports activities. Therefore, back problems may be reduced if the worker was to warm-up before lifting.

- Although physical and mental fatigue may lead to an increased risk of injury, mechanical stress on the spine is the more important factor.

B. Factors associated with the job and the environment

Working conditions which result in increased mechanical stress on the spine may increase the frequency of back problems. For example:

- Prolonged static work postures in either the standing or sitting position cause more mechanical stress on the spine.

- Physically demanding occupations are associated with higher rates of low back problems. Physical demand is determined by the amount of weight handled, the size of the load and the frequency of lifting required.

- Jobs that must be done in a bent-over work posture cause increased mechanical stress on the spine.

- Jobs with tasks that result in frequent unexpectedly high physical workloads including sudden, high intensity movements are associated with higher back injury risk.

- Occupations where the worker is exposed to excessive vibration (1-20 Hz) when sitting or standing may carry an increased risk. Vibration seems to cause an increased rigidity of the back making it more prone to injury.

- Compensated back injury is most commonly precipatated by lifting (50% of the cases). Other causes are pushing and pulling objects, slips, trips, and falls and bending and twisting motions.

IV. Prevention

The principles of prevention are:

- fitting the job to the worker; and
- fitting the worker to the job.

A. Fitting the job to the worker

The best way of preventing back injury is to ensure that the design of the job does not result in excessive forces on the back. Assessment of the work area and the job elements may reveal design or procedural changes which may help in eliminating the stresses that are likely to lead to back injury. Environmental conditions that can be controlled to limit the potential for back injury include mechanical, visual, thermal, chemical and material handling factors.

1. Mechanical environment

Mechanical factors that can be controlled are the container and container handle design, the working surface and mechanical alternatives to material handling.

a) Container design

-- Container design should ensure the container is as small as possible. Compact containers allow the load to be lifted from the floor in a position between the worker's legs, decreasing the potential pressure on the spine. Loads that can be carried close to the worker's body will decrease the stress on the spine. Dividers and packing in the box can be used to keep the centre of gravity of the box in a constant position by preventing the load from shifting.

-- Containers carried by the side of the body should be as narrow as possible. A weight carried in one hand should be counter balanced by one in the other hand.

-- Containers designed to be carried by one person in front of the body, grasping the forward edge, should not exceed 70 cm in length for males or 65 cm for females. To prevent interference with forward vision, the maximum height of the container above handle position should not exceed 83 cm for males and 80 cm for females.

b) Container handle design

-- Container handles should be placed above the container's centre of gravity. An exception to this may be made where the container would interfere with the worker's leg movement when the worker's arms are extended.

-- Failure to provide suitable handles for containers is often the reason for workers dropping containers resulting in injury and product damage. A good handle will have smooth edges (cylindrical handles with a diameter of 2.5 to 4 cm are best), and be long enough for the whole hand to grasp the handle comfortably (at least 11.5 cm with 5 cm clearance).

c) The work surface

-- To ensure a good footing when carrying a load, there must be sufficient friction between the footwear and the floor. The surface material, its surface coating and condition, floor angle, the composition of the footwear sole and its style are all factors that interact to determine this.

-- The floor should not be coated with a substance that will make it smoother (e.g. some waxes or smooth paints) and should be kept clean, clear and free from grease at all times. More friction is needed on steeper gradients to permit workers to exert the increased force necessary to move a load.

-- Different surface materials or coatings should have transition zones between them so that the changes in surface friction will be noticed. A change in surface friction should be clearly marked. Good housekeeping will prevent unforeseen changes in friction from spills, worn spots or loose or irregular floors.

-- Proper footwear is important. Shoe soles should be made of rubber or similar synthetic material for dry conditions. Leather soles may be better under wet conditions. Low wide heeled footwear is best.

2. Visual environment

The worker must be able to see the load, the area around the load, the surface on which he/she is working or the path he/she is taking while carrying the load. An illumination of at least 150 lux is recommended. Lighting should provide sufficient visual contrast to enhance surface texture and depth perception. Colour can be used to mark critical areas such as steps, ramps and other potentially dangerous areas. Yellow is the colour recommended for this purpose.

3. Thermal environment

Accident rates increase in a hot environment (over 21°C) with the greatest effect on the older worker. Cold environments do not seem to be of as great concern. However dexterity can be reduced in the cold; loads therefore should be designed to be lifted by workers wearing hand protection.

4. Chemical environment

Inhalation of toxic vapours and gases can cause effects on the nervous system such as dizziness, staggering, drowsiness, mental dullness or lack of awareness of self or surroundings. Irritant fumes can cause discomfort or affect the senses. Any of these factors contribute to injuries generally and to back injury accidents in particular. The chemical environment can be controlled by careful design of the workplace, by ventilation, by adequate housekeeping and by use of good control procedures. Levels of regulated contaminants must be kept below the limits stipulated in The Occupational Health and Safety Regulations, Part VIII.

5. Alternatives to materials handling

Jobs which entail frequent heavy lifting should be performed with the aid of some mechanical device or redesigned so that they can be performed with less risk to the back.

a) Lifting assists

Examples of aids for lifting are hooks, bars, rollers, jacks, platforms and trestles. All of these assist the worker and minimize stress on the worker's back. Care must be taken as there is a potential for danger in the use of each of these assists if proper procedures are not developed and used.

- Hooks are useful for handling bales and lumber. Care is required to make sure that the hook does not bounce off hard surfaces or slip and strike the worker.

- Crow bars slip easily; a wood fulcrum reduces the risk of slipping.

- Rollers are good for moving heavy and bulky items.

- Jacks are potentially dangerous; care must be taken to ensure the jack is designed to lift the load. The jack's capacity must be marked.

- Platforms are useful as they permit lifting and handling to be carried out at a convenient height.

- Trestles may be used for maneuvering long loads on the point of balance or for readjusting the grip or carrying posture.

b) Equipment for lifting loads between work stations

These include conveyors, cranes, hoists and industrial trucks. All these devices should be maintained and checked frequently for unsafe conditions. The correct selection of design and size can assist in the reduction of injuries. The equipment must be checked and operated by a trained operator in accordance with the requirements of the regulations.

8. Fitting the worker to the job

1. Medical assessment

Some employers have considered it desirable to have a physician predict whether an individual is more likely to injure his/her back on the job. Methods that have been used include back x-rays, strength testing and aerobic capacity testing. Back x-rays are not

supported as reliable indicators. Strength testing has recently become more popular but despite the enthusiasm, current evidence does not show reliability in long term predictions. Aerobic capacity testing as well has not been shown to predict the risk of future injury and the results are difficult to standardize from one laboratory to another.

The only factor that can be used to indicate high susceptibility, on a group basis, is the history of a previous injury but even this will not be specific to an individual worker. It is, therefore, futile to attempt to select workers on the basis of medical assessment.

The employer should be aware that not only is the medical prediction of susceptibility non-productive but it may also conflict with the human rights legislation if used as a pre-employment screening tool. Assessment of physical capability for doing the physically demanding tasks required by the job description is, on the other hand, useful in selection of workers for jobs with higher strength requirements.

2. Worker education

For many years a great deal of effort has been put into the training of workers in proper lifting techniques. This has not lowered the incidence of back injury and may have contributed to it. Instruction to "lift with your knees" may lead to lifting at arm's length in front of the knees, putting more stress on the spine than bending at the waist. The concept of a universally applicable "correct" lifting method is biologically unsupported.

Education should not be an end in itself but an adjunct to the modifications in the workplace to reduce back injury. Emphasis should be on:

- The risk to the unskilled in handling loads.
- The basic physics of moving loads including an understanding of levers and pulleys.
- The effect of lifting, pushing, pulling and carrying on the body.
- How much each individual can handle.
- How to avoid the unexpected to prevent an accident.
- How best to handle a load.
- Alternate materials handling tools.

The teaching should include on-site consideration of the classroom material.

3. Physical fitness

The literature on the effect of physical fitness is not clear. It is generally held that those in good physical condition are less likely to have back injuries. Those with injuries have been found to have weak abdominal muscles. Studies on firefighters and ambulance attendants showed a significantly lower number of back injuries in those who were fit. More research needs to be done in this area.

Exercises that improve back flexibility and build stomach, hip and trunk muscles are particularly good for the back. Exercises to strengthen leg and arm muscles are also useful since these muscles are meant to take the load off the back when moving heavy objects. However, some exercises put excessive strain on the lower back and should not be tried without the advice of the physician, eg. any exercise which arches or overstrains the lower back.

4. Work posture

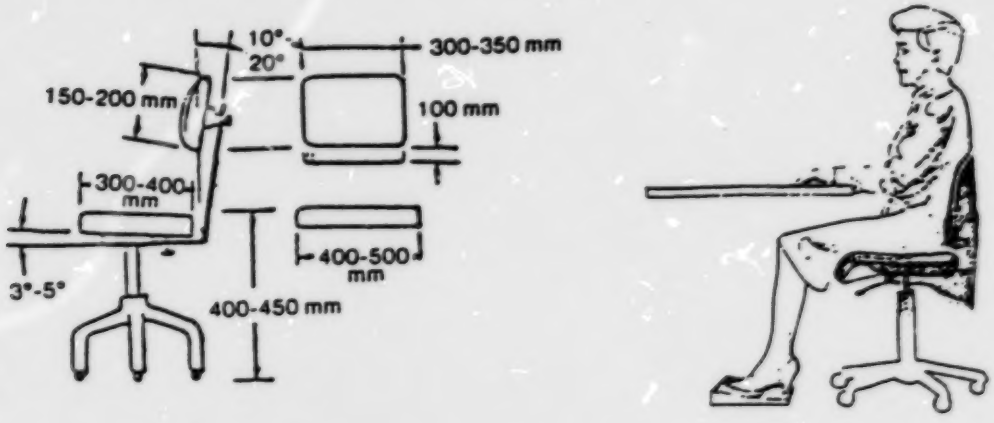
Static work postures can cause postural fatigue which is associated with increased absenteeism due to low back problems. It is suggested that work in a static position tires the muscles and makes the back more susceptible to injury. There are some studies that support this association. The following recommendations help reduce postural fatigue:

- Where workers are required by the nature of their work to stand for long periods, mats of soft floor covering are beneficial; the harder the floor surface, the more stress is induced.

Means of reducing postural fatigue: a work bench that eliminates the need to work with a bent spine (right).

- Foot rests, stools or supports are mandatory where they can be used. The opportunity to change position, to move around or sit periodically is also beneficial.

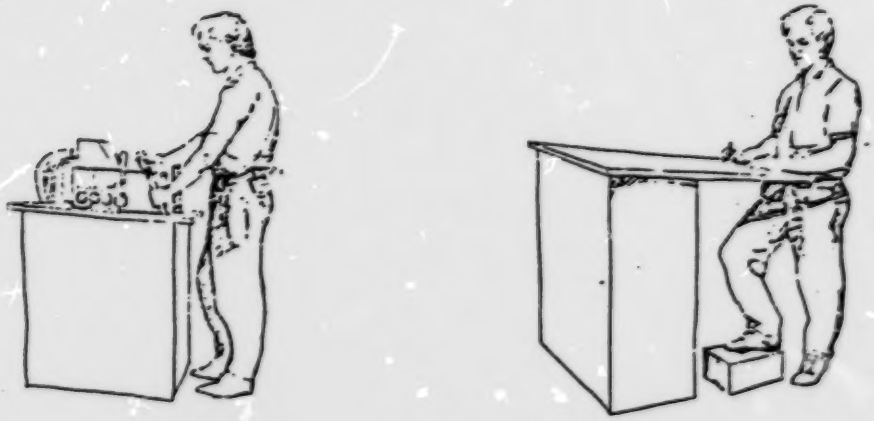
- For workers required to sit for long periods, appropriate seating with high backrest for support should be provided wherever it is reasonably practicable.



Optimum seat adjustments for desk work.

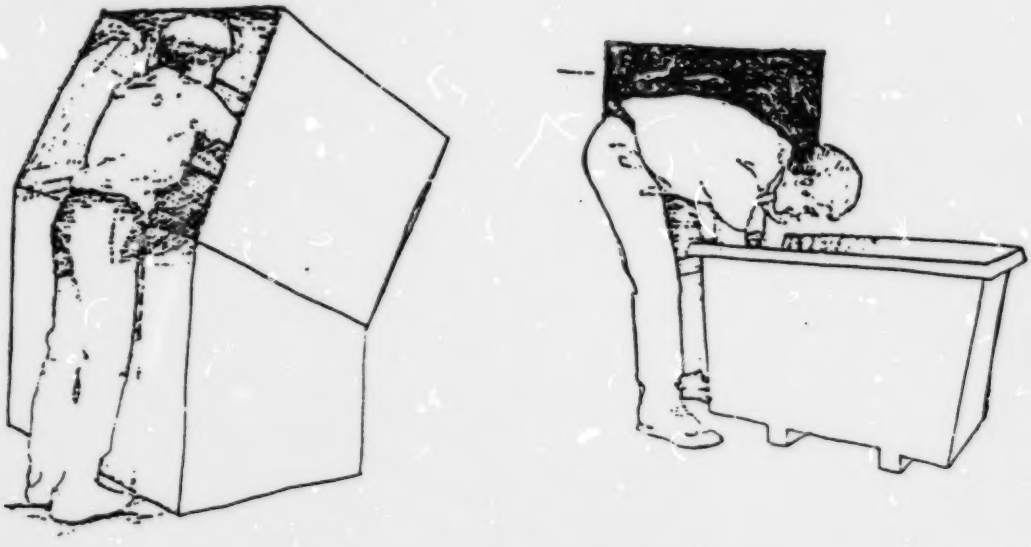
- Adequate lighting helps to prevent stooping.

- Work surface heights should be appropriate to the job (eg. high for precision work and low for work which requires exertion).



Means of reducing postural fatigue: a low work surface height (left) for tasks requiring exertion and high work surface height (right) for tasks requiring precision.

- Design a layout for the workplace that reduces postural fatigue, eg. suitably located shelves and work surfaces that do not require over-reach; containers or bins that do not require stooping (use ones with removable sides whenever possible) and suitably designed work stations that reduce the need for twisting, stretching or leaning.



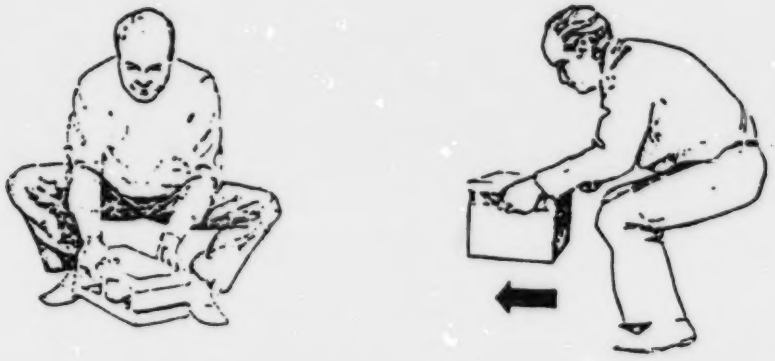
Means of reducing postural fatigue: a suitably designed work station (left).

5. Lifting

As lifting is the major factor contributing to back injury, a great deal of attention has been focused on "proper" lifting techniques.

The two major methods of lifting are the bent back position that uses the back muscles in lifting (stooped lift) and the squat position that keeps the back straight and the knees bent with the leg muscles doing the lifting. Neither of these methods is suitable for universal application. The squat method has an advantage only if the object being lifted can be comfortably placed between the knees, thus keeping its centre of gravity close to the body. The lower back can be seriously injured if the centre of gravity of the load is too far from the body. The squat method has been promoted for a number of years with no reduction in the back injury rate. It is a less efficient technique because it has a higher metabolic demand, particularly important with heavy repetitive operations where fatigue becomes an important issue.

At the present time, there is no adequate scientific basis to set a "load limit" or a "maximum load limit" that can be incorporated in regulations. This is because object weight is not the only factor. Other considerations which modify the effects of a given load include: where the weight is located (horizontally and vertically); how far it must be moved and how frequently; the stability of the load; the adequacy of the grip; the presence of obstacles in the worker's path; the space constraints; and the rest time between lifts.



The squat method has an advantage only if the object can be comfortably placed between the knees (left). The lower back can be seriously injured if the centre of gravity of the load is too far from the body (right).

The task of lifting should be controlled to reduce the two previously described risks associated with back injury: twisting (torsional overload) and compression stresses (axial overload).

The following suggestions help to reduce twisting while lifting or carrying:

- Widen the base of support by keeping feet shoulder width apart.

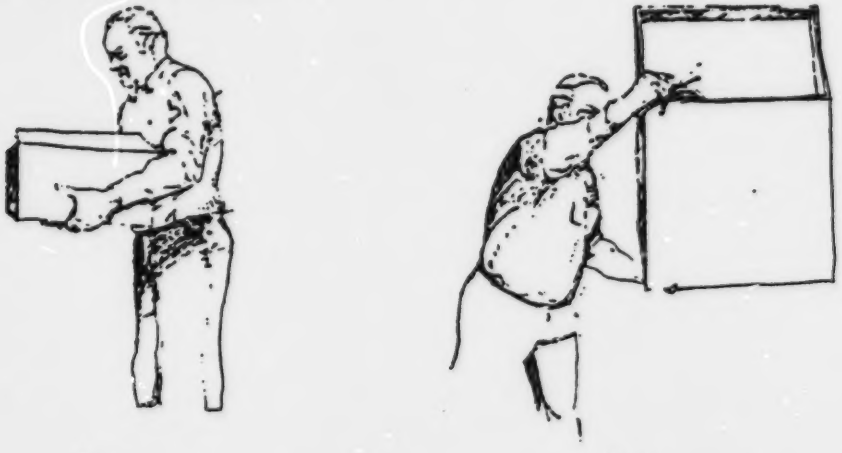
←base of support→

Prevent spine twisting: widen base of support and keep load within base of support - keep your feet shoulder-width apart.

- Keep the centre of gravity stable by preventing the load from shifting or your body from losing its balance.

- Keep the centre of gravity within the base of support by carrying the load close to the body, within the base of support and close to waist level if possible.

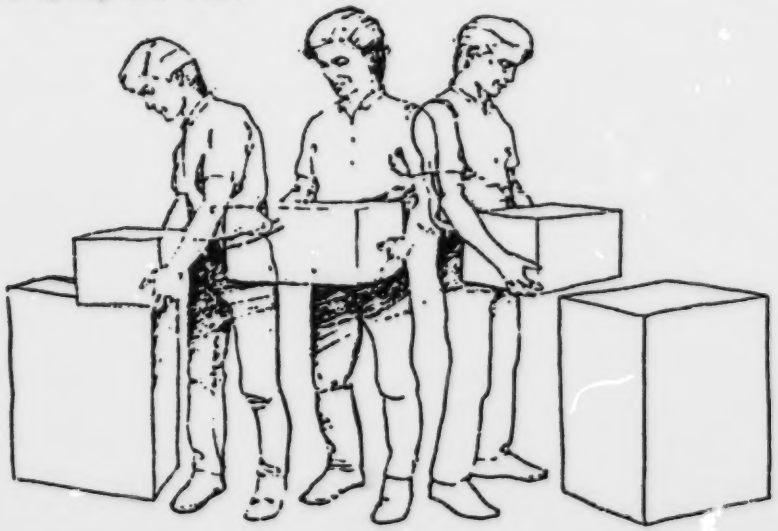
- Ensure a good grip to reduce the chances of load dropping or slipping from the hands with the resultant spontaneous jerking motion to save the load.



Good Bad

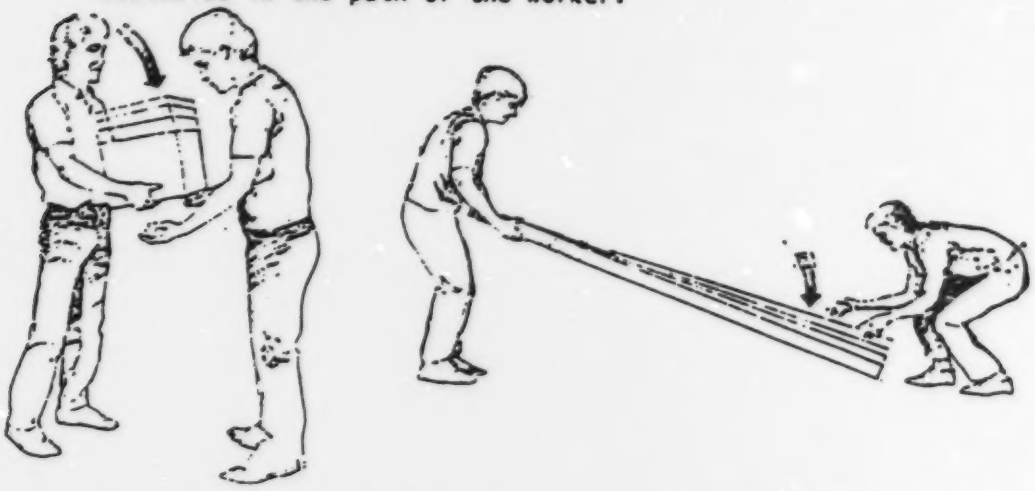
Prevent spine twisting: Ensure a good grip and keep centre of gravity stable to reduce chances of load dropping or slipping.

- Turn from the feet to avoid twisting or turning the spine while carrying the load.



Prevent spine twisting: turn from the feet to avoid twisting or turning the spine while carrying the load.

- Avoid the unexpected by preparing beforehand to ensure smooth handling. Clear the area for setting the loads down and remove obstacles in the path of the worker.



Prevent spine twisting: inadequate preparation in unloading (right) and in catching heavy objects (left) can lead to sudden jerking pulls on the back.

The following suggestions help to reduce the compression stress on the spine and to reduce general fatigue which predisposes to back injury:

- The effects of object weight should be minimized by purchasing the material in smaller containers; by having more than one worker participate in the lift; and/or by assessing how much each individual worker can handle.

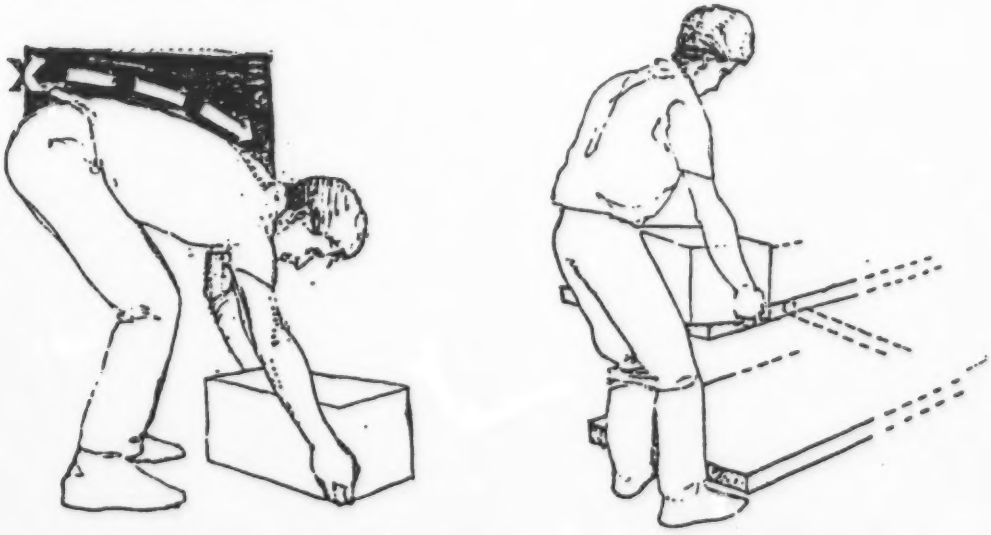
- Move the object closer to the body to reduce compression stress induced in the spine.

Reduce compression on the spine: keep load close to body (right).

- Have the object as close to waist height as possible before lifting, if necessary by using two phase lifting; bring weight onto the thighs first before coming to the erect position.

Reduce compression on the spine: keep lifts between shoulder and knuckle height. Avoid high lifts.

- Keep the vertical distance of the lift to a minimum, for example by using adjustable platforms. The addition of handles decreases the vertical distance.



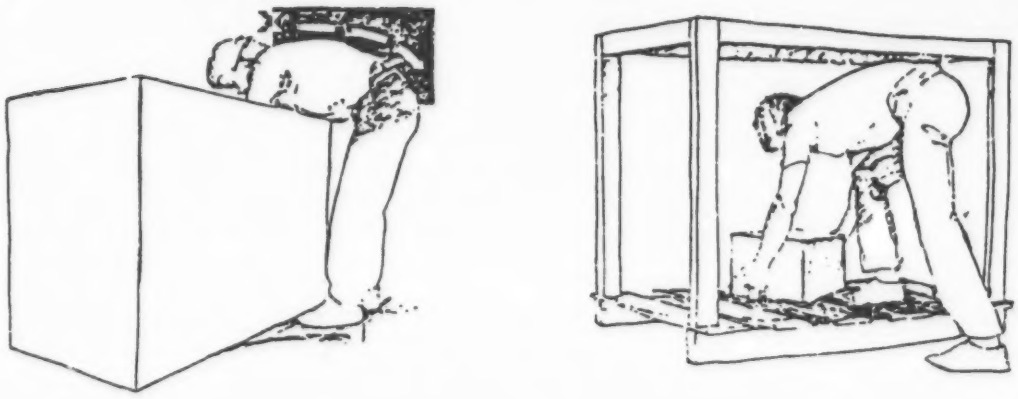
Reduce compression on the spine: reduce vertical travel distance from origin to destination of lift, e.g. by providing adjustable platforms or even pallets (right).

- Pacing lifting in high frequency lifting jobs can reduce the fatigue which predisposes to back injury.

- Add handles using the guidelines previously outlined.

- Objects of uniform shape are easier to lift.

- A compact, secure load decreases the risk of unexpected movement or the load with the resultant uncontrolled muscular reaction.



Reduce compression on the spine. minimize upper body movement by avoiding stooping into deep bins (left) or inside constricted spaces (right).

V. Responsibility for Prevention

Sections 44, 45 and 46 of The Occupational Health and Safety Regulations require the employer to take certain actions to ensure the protection of the safety of workers handling materials. Section 42 deals with the requirement for provision of appropriate seating and Part XVI and XVII deal with walking surfaces to prevent slipping, tripping or falling.

The regulations recognize that engineering and ergonomic means are the key preventative measures to avoid back injury. The employer is required to ensure insofar as is reasonably practicable that suitable mechanical equipment is provided and used for handling heavy or awkward loads. These include mechanical aids such as conveyors, cranes and hoists and industrial trucks. Where the use of mechanical equipment is not reasonably practicable, the employer is required to take all practicable means to adapt heavy or awkward loads to facilitate lifting, holding or transporting by workers. These means may include partitioning of the load, use of lifting assists, use of suitably designed containers or other means to reduce the stress on the spine.

The regulations prohibit the employer from requiring a worker to engage in the manual lifting, holding or transporting of any load which by reason of its weight, size or shape, or by any combination of these, or by reason of the frequency, speed or manner in which it is undertaken, is likely to be injurious to the worker's health or safety. In not specifying a maximum or a permissible weight limit, the regulations recognize the importance of various task variables and the characteristics of the load in determining the stress exerted on the spine while doing the task. There is no adequately validated scientific ground for stipulating a maximum permissible weight limit. It is expected, however, that the employer should try to match the worker to the task as much as possible and ensure that the frequency of heavy lifting is paced by the worker. In hiring or replacing a worker the employer should acquaint the worker with the tasks involving manual material handling and ensure that the worker is physically capable of doing them without excessive strain. This is particularly important since there seems to be correlation between risk of back injury and handling weights greater than the weight an individual is willing to handle.

The regulations also require the employer to ensure that any worker who is to engage in the lifting, holding or carrying of loads receives appropriate training in the safe methods for these activities. The purpose of this section is to protect the younger, unskilled and inexperienced workers who have been shown to be at greater risk. The training should not be directed towards a "correct" lifting method, which has proven to be ineffective, but rather to the principles outlined in this booklet.

The employer is required to provide suitably designed, constructed, dimensioned and supported seating and footrests where needed. This should help prevent improper work posture which increases the risk of back injury. The thermal, visual and chemical environments which are factors contributing to back injury accidents, are regulated by Sections 33, 34 and 72 respectively, of the Occupational Health and Safety Regulations.

The employer is required to implement various arrangements for safety in connection with the use, handling, storage and transport of articles and substances. These include arrangements for the prevention of unforeseen incidents which can account for more than half the cases of occupational back injuries such as adverse underfoot conditions (slipping and tripping surfaces, walkways, stairs and ladders, collapsed surfaces and moving surfaces) and other causes of loss of balance.

It is the worker's responsibility to take reasonable care to protect his/her health and safety and the health and safety of other workers who may be affected by his/her acts or omissions. It is also the worker's responsibility to co-operate with the employer in ensuring the use of mechanical lifting equipment and lifting aids whenever possible and in using the training provided to improve his/her lifting skills.

VI. Application to the Work Site

1. Work site assessment

- What is your W.C.B. back injury rate?
- How does it compare to other businesses of a similar nature?
- What types of jobs were the injuries associated with?
- What were the causes of the injuries?

2. Jobs at risk

- Does the worker have to stand or sit for long periods of time?
- Does the job have a high physical demand; assessed by the weight handled, the load size and the lift frequency?
- Is the job done in a bent-over posture?
- Does the job have high physical workloads that are unexpected?
- Is the worker exposed to excessive vibration while doing the job?

3. Fitting the job to the worker

- Are the temperature and humidity levels comfortable?
- Is the general area and task lighting level adequate?
- Is the worker exposure to chemicals, especially those containing solvents, adequately controlled?
- Are the noise and the vibration levels adequately controlled?

- How well is the work space designed?
  - is the horizontal reach greater than necessary?
  - is the vertical reach greater than it should be?
  - is the work-surface at the correct height?
  - is the amount of leg room adequate?
  - is too much twisting required?
  - is the worker able to perform the job in a suitable position?

- How good is the seating provided?
  - is its adjustability, design, construction and dimensions suitable?
  - are footrests available?

- Have the characteristics of the object being lifted been considered?
  - its dimensions;
  - its weight;
  - its shape;
  - the stability of the load;
  - are suitable handles fitted?

- Have the characteristics of the task been considered?
  - the horizontal distance of the object from the feet;
  - the vertical height of the starting point;
  - the vertical distance of the lift;
  - the frequency of the lift;
  - the duration of the lift;
  - the accuracy of placement required.

- Have the characteristics of the work surface been considered?
  - is it too rough?
  - is it clean and clear?
  - is there adequate friction for steeper gradients?
  - are changes in surface friction clear marked?
  - is the housekeeping good?
  - is appropriate footwear worn?

- Have alternatives to materials handling been considered?
  - is there a need to provide lifting assists or mechanical equipment for lifting or moving the loads?
  - have the use of existing lifting assists and equipment been maximized?
  - is the worker adequately trained in using these assists and equipment?
  - does the equipment and its operation conform with the requirements of the regulations?

4. Fitting the worker to the job

- Has the worker been acquainted with the manual handling tasks?
- Has the worker been educated in proper lifting and the hazards of improper lifting?
- Is the worker physically fit? Are there motives to maintain or improve his/her fitness?
- Is the work area design and layout conducive to maintaining good posture?

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S7K 2H6

Workplace Safety Unit	933-5051
Manager, Mine Safety Unit	933-5055

Consolidated copies of *The Occupational Health and Safety Act* and *The Occupational Health and Safety Regulations* are available for $6.50. To order, contact the order office of the Queen's Printer, 8th floor, 1874 Scarth St., Regina S4P 3V7 (phone 787-6894).

A catalogue of audiovisuals available from the Occupational Health and Safety Branch may be obtained free of charge by contacting the library at 787-2422.

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